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MEMORANDUM **March 21, 2014**

Subject: EFED Response to Florida's Section 18 Emergency Exemption for the Use of Clothianidin to Control Asian Citrus Psyllid Transmission of Huanglongbing disease to Bearing and Non-Bearing Citrus Trees.

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This memorandum transmits the Section 18 Ecological and Environmental Risk Conclusions, based on the Environmental Fate and Ecotoxicity Assessment for the proposed emergency exemption use on citrus (bearing and non-bearing trees) in Florida of Belay® Insecticide (EPA Reg. No. 59639-150, active ingredient: clothianidin). The maximum proposed single application rate is 0.2 lb a.i./A as a soil drench to young citrus trees (≤ 5 years old), with a maximum of 0.4 lb a.i./A (all application methods) applied in a 12-month period. The maximum single application rate is similar to other currently registered soil application rates on brassica, cucurbit, fruiting and leafy vegetables. However those crop groups have a lower seasonal maximum application rate limit of 0.2 lb a.i./A.

Based on estimated maximum application rates, exposure levels and available effects data, clothianidin use on citrus in Florida may lead to listed and non-listed species effects on freshwater and estuarine/marine invertebrates, birds, mammals and beneficial terrestrial invertebrates from acute and chronic exposures. These conclusions do not account for the potentially additive effects of rotating use of other neonicotinoids (imidacloprid and thiamethoxam) in the proposed treatment program.

1 SUMMARY- USE CHARACTERIZATION

Clothianidin is a nitroguanidine-substituted neonicotinoid insecticide and is expected to persist in the environment, except in clear shallow waters where photolysis is expected to dominate. The compound is taken up by plants where it is distributed systemically in plant tissues. Currently there is a Section 24 SLN label (EPA Registration No. 59639-152) allowing maximum single applications of 0.2 lb a.i./A (0.4 lbs a.i./A maximum yearly application) on non-bearing (< 3 year old) citrus trees. Proposed emergency exemption label language indicates that clothianidin requires a minimum of 6 weeks between applications for nonbearing citrus trees and a minimum of 4 months between applications to bearing citrus (3-5 year old trees). Additionally, the proposed label specifies that clothianidin soil applications cannot be made from November 1st until the end of the following citrus bloom period.

The Section 18 label states "Applicable directions, restrictions and precautions on the registered product label for *Belay*® Insecticide (EPA Registration No. 59639-150) must be followed".

The proposed Section 18 label for citrus in Florida contains the following environmental hazard statements

- This product is toxic to aquatic invertebrates. Do not apply when weather conditions favor drift from treated areas. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.
- This product is toxic to bees exposed to treatment and for more than 5 days following treatment. Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period. Fall soil application of 3-5 year old citrus may pose risks to honey bees that forage in the trees during the winter/spring bloom. Applicators are advised to help mitigate such risks by cooperating with the Florida Department of Agriculture and Consumer Services in its efforts to communicate hive location/placement options with local bee keepers (*sic*). For further information, see www.FloridaBeeProtection.org.
- The properties of this chemical suggest it may leach into ground water if used in areas where soils are permeable and where the water table is very shallow. Do not apply within 25 feet of lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries or commercial fish farm ponds.

The major risk concerns are for aquatic invertebrates (free-swimming), small birds, small and medium sized mammals and beneficial terrestrial invertebrates. Clothianidin is highly toxic to honey bees (*Apis mellifera*) on both an acute contact and oral exposure basis, and bees may be exposed to residues resulting from residues translocated in the plant to pollen and nectar. This assessment attempted to quantify the risks to honeybees based on both modeled concentrations and empirical data.

Potential risk from the proposed use on citrus to Federally-listed threatened/endangered species (hereafter referred to as "listed" species) and non-listed species are as follows:

- Acute listed species and chronic levels of concern (LOCs) were exceeded for freshwater invertebrates who reside in the water columns.
- The proposed use pose acute risk to listed species of small birds feeding on short grass and broadleaf plants, acute risk to small and medium mammals feeding on short grass and chronic risk to all size classes of mammals feeding on short grass, small and medium sized mammals feeding on broadleaf plants and small mammals feeding on tall grass.
- The proposed use also poses risk to nonlisted and listed species of beneficial terrestrial invertebrates.

Potential effects to federally-listed endangered and threatened species (hereafter referred to as "listed" species) based on LOC exceedances require a more in-depth evaluation to determine the potential co-occurrence of listed species and the areas in which rice and leafy greens are grown. Potential risks to listed species are summarized in **Table 1;** a summary of the listed species that are located in Florida where the assessed crops are grown is found in **Appendix A**.

Table 1. Potential Effects to Federally Listed Taxa Associated with Direct or Indirect Effects from the Proposed Application of Clothianidin use on Citrus Fruit.

Listed Taxon	Direct Effects	Potential Indirect Effects
Terrestrial and semi-aquatic plants – monocots	No	Yes[1,2]
Terrestrial and semi-aquatic plants – dicots	No	Yes[1,2]
Terrestrial invertebrates	Yes	Yes[1,2]
Birds	Yes	Yes[1,2]
Terrestrial-phase amphibians	Yes	Yes[1,2]
Reptiles	Yes	Yes[1,2]
Mammals	Yes	Yes[1,2]
Aquatic vascular plants	No	Yes[3]
Aquatic non-vascular plants	No	Yes[3]
Freshwater fish	No	Yes[3]
Aquatic phase amphibians	No	Yes[1,3]
Freshwater Invertebrates	Yes	Yes[1,3]
Mollusks	No	No
Marine/estuarine fish	No	No
Marine/estuarine invertebrates	No	No

Potential indirect effects on a taxon attributable to:
[1] potential direct effects on mammals, birds, terrestrial amphibians and reptiles
[2] potential direct effects on terrestrial invertebrates
[3] potential direct effects on freshwater invertebrates

2 SUMMARY- ENVIRONMENTAL FATE

Based on available data, clothianidin is persistent under most field and laboratory conditions and is mobile to highly mobile based on laboratory adsorption tests. **Table 2** shows the proposed maximum application rates supported by the Section 18 petition; application frequency and intervals between applications are also presented. The estimated environmental concentrations (EECs) listed in **Table 3** for surface water resulting from soil drench applications to citrus fruit group were used to calculate RQ values.

Table 2. Summary of registered (trees < 3 years old) and proposed (trees 3-5 years old) maximum application methods for the Section 18 Use on Citrus Trees

Use	Tree Age (Size)	Maximum Single Application Rate (lb a.i./A)	Maximum Number of Applications per Year	Maximum Seasonal Application Rate (lb a.i./A)	Minimum Interval (days)
Citrus	< 1 year old (< 3 feet)	0.05 (0.0003 lb ai/tree)	NS	0.4	42
	1-2 years old (3-5 feet)	0.1 (0.0007 lb ai/tree)	NS	0.4	42
	3-5 years old (5-9 feet)	0.2 (0.0013 lb ai/tree)	2	0.4	112

Estimated Environmental Concentrations for clothianidin are presented in **Table 3** for the USEPA standard pond with the FLcitrusSTD field scenario, and the meteorological file w12844. A graphical presentation of the year-to-year peaks is presented in **Figure 1**. These values were generated with the Surface Water Calculator (Version 1.09). Critical input values for the model are summarized in **Table 4**. Comparison of previous modeling runs using the graphical user interface, PE5, for a foliar application, showed that the SWC gave EECs approximately 59% of the PE5 results for all averaging periods. The differences are due in part to calculating averages from daily averages rather than from daily peak concentrations, as well as model code corrections.

This model estimates that about 0.41% of clothianidin applied to the field eventually reaches the water body. The main mechanism of transport from the field to the water body is by runoff (nearly 100% of the total transport), followed by erosion (0.29%). The application method, soil drench, was assumed to result in no spray drift, and was assumed to reach a depth of 10 cm.
In the water body, pesticide dissipates with an effective water column half life of 181.9 days. (This value does not include dissipation by transport to the benthic region; it includes only processes that result in removal of pesticide from the complete system.) The main source of dissipation in the water column is metabolism (effective average half life = 194 days), followed by photolysis (2900 days), and volatilization (negligible dissipation).
The main source of dissipation in the benthic region is metabolism (effective average half life = 29 days). The vast majority of the pesticide in the benthic region (94.53%) is sorbed to sediment rather than in the pore water.

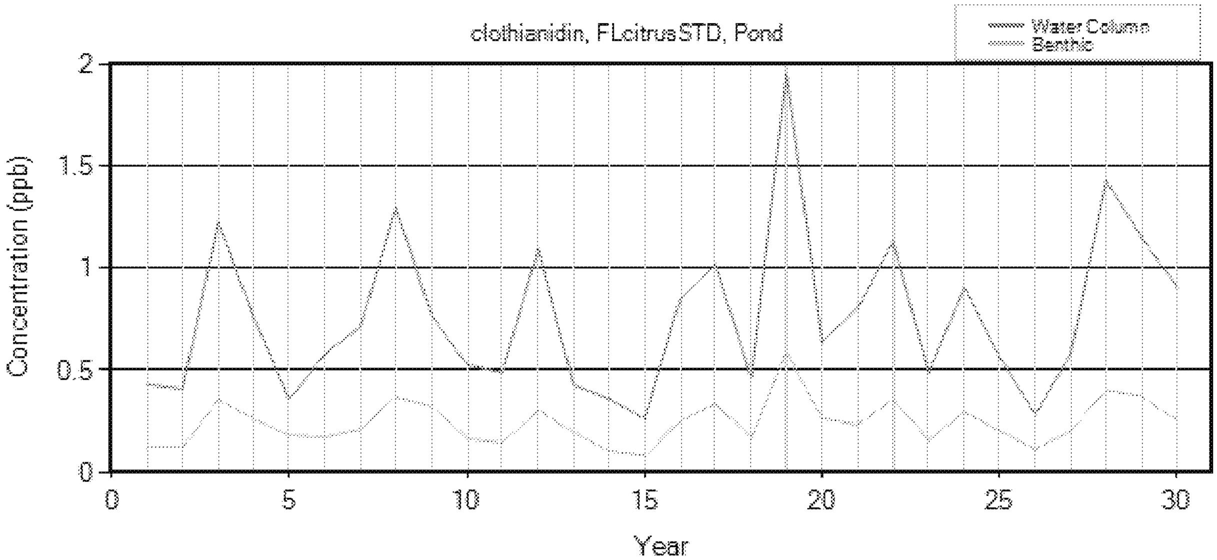
Table 3. Estimated Environmental Concentrations (ppb) for clothianidin. (Averaging Period)	Water column	Benthic Pore water	Benthic Dry Sediment
Peak (1-in-10 yr)	1.29	0.374	2.53
4-day Avg (1-in-10 yr)	1.27	nc (1)	Nc
21-day Avg (1-in-10 yr)	1.20	0.371	2.51
60-day Avg (1-in-10 yr)	1.08	nc	Nc
365-day Avg (1-in-10 yr)	0.607	nc	Nc
Entire Simulation Mean	0.381	nc	Nc

(1) not calculated

Table 4. Summary of Model Inputs for clothianidin.

Scenario	FLcitrusSTD
Koc (ml/g)	160
Water Half Life (days) @ 25 °C	180.5
Benthic Half Life (days) @ 25 °C	27
Photolysis Half Life (days) @ 40 °Lat	34
Hydrolysis Half Life (days)	0
Soil Half Life (days) @ 25 °C	744
Foliar Half Life (days)	35
Molecular Wt	249.7
Vapor Pressure (torr)	2.9e-13
Solubility (mg/l)	327

Figure 1. Yearly Peak Concentrations



3 SUMMARY- ECOLOGICAL EFFECTS

Based on the available data (**Table 5**), clothianidin is moderately toxic on an acute basis to birds and mammals and practically non-toxic to birds on a subacute dietary basis. No data on the effect of acute exposure of clothianidin to passerines is available; the potential effects to passerine species are uncertain. Available data on avian reproduction indicate that clothianidin reduced eggshell thickness at concentrations above 205 mg/kg-diet, though no other chronic endpoints were affected at the concentrations tested (up to 525 mg/kg-diet). The available two generation mammalian reproduction study indicated reduced body weight and delayed sexual maturation in male rats (NOAEL of 9.8 mg/kg-bw/d). Clothianidin is very highly toxic to bees on both an acute contact and acute oral basis. In Tier I terrestrial plant testing, no adverse effects have been observed at rates up to 0.19 lb a.i./A.

For aquatic organisms, the available data suggest clothianidin is slightly toxic to practically non-toxic to freshwater and estuarine/marine fish on an acute exposure basis (**Table 5**). Clothianidin is practically non-toxic to daphnids, but very highly toxic to mysids and benthic freshwater invertebrates (midges). On a chronic basis, clothianidin resulted in reduced growth (length and weight) in fathead minnow (NOAEC = 9,700 ppb) and inhibited reproduction in daphnids (NOAEC < 42 ppb) and mysids (NOAEC = 5.1 ppb). A 10-d study with the midge obtained a NOAEC of 1.1 ppb based on growth inhibition, but was unable to evaluate reproductive effects due to the short duration of the study. Due to the known lack of sensitivity of daphnids to clothianidin and other neonicotinoids and the significant taxanomic differences between daphnids and other freshwater insects that may be exposed in the water column, the midge acute and semi-chronic (10-d) data is used in place of the daphnid data for risk estimation in this assessment.

For aquatic non-vascular plants, the EC_{50} and NOAEC based on biomass were 64,000 ppb and 3,500 ppb, respectively for green algae. For aquatic vascular plants, the EC_{50} and NOAEC were 121,000 ppb and 59,000 ppb, respectively for duckweed based on necrotic fronds.

Table 5. Summary of the Endpoints from Submitted Terrestrial Toxicity Studies for Clothianidin

Study Type	Species	Toxicity Value	Toxicity Classification	MRID & Status
Acute – Avian Oral 850.2100	Japanese Quail (*Coturnix coturnix japonica*)	LD_{50}: 423 mg/kg-bw/day	Moderately toxic	45422418 Supplemental
Acute – Avian Dietary 850.2200	Mallard Duck (*Anas platyrhynchos*)	5-day LC_{50}: >5,040 ppm	Practically non-toxic	45422420 Acceptable
Chronic – Avian Reproduction 850.2300	Bobwhite Quail *(Colinus virginianus*)	NOAEC: 205 ppm LOAEC: 525 ppm (eggshell thickness)	N/A	45422421 Acceptable
Acute – Mammalian Oral 870.1100	Mouse (*Mus musculus*)	LD_{50} =389-465 mg/kg/day	Moderately toxic	45422622 Acceptable
6Two-generation Mammalian Reproduction 870.4100	Rat (*Rattus norvegicus*)	NOAEL (M/F) = 9.8/11.5 mg/kg/day	N/A	4522714-16 and 45422825-26
Acute Oral--Honeybee NG	Honeybee (*Apis mellifera*)	48-hr LD_{50} = 0.00368 µg/bee	Highly Toxic	45422426
Acute Contact-Honeybee 850.3020	Honeybee (*Apis mellifera*)	48-hr LD_{50} = 0.0439 µg/bee	Highly Toxic	45422426

Table 6. Summary of the Endpoints from Submitted Aquatic Toxicity Studies for Clothianidin

Study Type	Species	Toxicity Value	Toxicity Classification	MRID & Status
Acute – Freshwater Fish 850.1075	Rainbow trout *(Oncorhynchus mykiss*)	96-hr LC_{50}: >101,500 ppb	Practically non-toxic	454224-06 Supplemental
Acute – Estuarine/Marine Fish 850.1075	Sheepshead minnow *(Cyprinodon variegatus*)	96-hr LC_{50}: > 91,400 ppb	Slightly toxic	454224-11 Supplemental
Chronic – Freshwater Fish 850.1400	Fathead Minnow (Pimephales promelas)	NOAEC: 9,700 ppb LOAEC: 20,000 ppb	N/A	454224-13 Supplemental
Chronic-- Saltwater Fish 850.1400	N/A	NOAEC: 9,700 ppb[1]	N/A	Data Gap

<table>
<tr><th colspan="5">Table 6. Summary of the Endpoints from Submitted Aquatic Toxicity Studies for Clothianidin</th></tr>
<tr><th>Study Type</th><th>Species</th><th>Toxicity Value</th><th>Toxicity Classification</th><th>MRID & Status</th></tr>
<tr><td>Acute – Estuarine/Marine Invertebrate 850.1035</td><td>Mysid shrimp (Americamysis bahia)</td><td>96-hr LC_{50}: 53 ppb</td><td>Very highly toxic</td><td>454224-03 Acceptable</td></tr>
<tr><td>Acute – Freshwater Invertebrate (sediment) 850.1010</td><td>Midge (Chironomus riparius)</td><td>48-hr EC_{50}: 22 ppb</td><td>Very highly toxic</td><td>454224-14 Supplemental</td></tr>
<tr><td>Acute – Freshwater Invertebrate 850.1010</td><td>Water flea (Daphnia magna)</td><td>48-Hr EC_{50} > 119,000 ppb</td><td>Practically non-toxic</td><td>454223-38 Acceptable</td></tr>
<tr><td>Chronic— Freshwater Invertebrate (sediment) 850.1790</td><td>Midge (Chironomus riparius)</td><td>10-d LC_{50} = 11 ppb (pore water)
NOAEC = 1.1 ppb</td><td colspan="2">468269-02 Supplemental</td></tr>
<tr><td>Chronic – Freshwater Invertebrate 850.1300</td><td>Water flea (Daphnia magna)</td><td>NOAEC: < 42 ppb</td><td colspan="2">454224-12 Supplemental</td></tr>
<tr><td>Chronic – Estuarine/Marine Invertebrate 850.1350</td><td>Mysid shrimp (Americamysis bahia)</td><td>NOAEC: 5.1 ppb
LOAEC: 9.7 ppb (reproduction)</td><td colspan="2">454224-05 Acceptable</td></tr>
<tr><td>Chronic Estuarine/Marine Invertebrate (sediment)</td><td>Estuarine amphipod Leptocheirus plumulosus</td><td>LC_{50} = 20.4 ppb (pore water)
NOAEC = 11.6 ppb</td><td colspan="2">471994-01 Supplemental</td></tr>
<tr><td>Aquatic – Non-vascular Plants 850.5400</td><td>Green algae (Pseudokirchneriella subcapitata) [Tier 2]</td><td>120-hour EC_{50}: 64,000 ppb
NOAEC: 3,500 ppb (biomass)</td><td colspan="2">45422504 Acceptable</td></tr>
<tr><td>Aquatic – Vascular Plants 850.4400</td><td>Duckweed (Lemna gibba) [Tier 2]</td><td>EC_{50}: >121,000 ppb
NOAEC: 59,000 ppb (necrotic fronds)</td><td colspan="2">45422503 Acceptable</td></tr>
</table>

[1] The chronic freshwater fish NOAEC is used since no chronic saltwater fish data is available, and an ACR approach cannot be used due to the lack of a definitive acute endpoint.

4 SUMMARY- RISK CONCLUSIONS

4.1 Risk to Aquatic Animals and Plants

Available data indicate a potential for acute risk to listed species of freshwater invertebrates **(Table 7)** residing in the water column and chronic risk to listed and non-listed species of freshwater invertebrates residing in the water column. Where exceedances to an acute LOC are determined, individual effect probabilities are calculated based on an Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) developed by the U.S. EPA, OPP, Environmental Fate and Effects Division (USEPA, 2004). The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. In addition, the acute RQ is entered as the desired threshold.

TABLE 7. Summary of Environmental Risk Conclusions for Aquatic Organisms

Assessment Endpoint	LOC Exceedances	Summarized Risk Characterization
Acute Risk to Freshwater Fish and Water Column Freshwater Invertebrates	**Listed Freshwater Invertebrates**	**Freshwater Fish Acute RQ < 0.01** **Freshwater Invertebrate Acute RQ = 0.059** At the peak EEC (1.29 ppb ai/L), there are no exceedances of either the non-listed species acute risk or the listed species acute risk LOCs for freshwater fish or the non-listed species acute risk LOC for freshwater invertebrates. However, there is a marginal exceedance of the listed species acute risk LOC for freshwater invertebrates. Based on the RQs and the LC_{50}/EC_{50} in the most sensitive acute freshwater invertebrate study and using the default slope of 4.5 (95% CI: 2—9), calculations were made to determine the probability that a particular individual would be killed by the maximum EECs predicted in this assessment. The individual probability of death is < 0.01% or 1 in 62,900,000 animals (95% CI: <0.01%--0.7%) for freshwater invertebrates.
Acute Risk to Freshwater and Estuarine/Marine Benthic Invertebrates	None	**Freshwater Benthic Invertebrate Acute RQ = 0.017** At the peak pore water benthic EEC (0.374 ppb ai/L), there is no exceedance of either the non-listed species or the listed species acute risk LOC for freshwater benthic invertebrates. There are no acute toxicity data available for saltwater benthic invertebrates, however if either the 48-hour mysid LC_{50} endpoint (LC_{50} = 53 ppb) or the 10-d estuarine amphipod LC_{50} were used (LC_{50} = 20.4 ppb), the RQs would still be below any LOCs.

TABLE 7. Summary of Environmental Risk Conclusions for Aquatic Organisms		
Assessment Endpoint	**LOC Exceedances**	**Summarized Risk Characterization**
Chronic Risk to Freshwater and Estuarine/Marine Benthic Invertebrates	None	**Freshwater Benthic Invertebrate Chronic RQ = 0.34** **Estuarine/Marine Benthic Invertebrate Chronic RQ = 0.03** At the 21-day pore water EEC (0.371 ppb ai/L), there is no exceedance of the Chronic Risk LOC for freshwater or estuarine/marine benthic invertebrates. This likely underestimates the chronic risk to benthic invertebrates, as the chronic toxicity endpoints are based on the 10-d midge and estuarine amphipod NOAECs, which do not include reproductive endpoints (which were the most sensitive endpoints in the chronic daphnid and mysid studies).
Chronic Risk to Freshwater Fish and Water Column Invertebrates	**Listed and non-listed Freshwater Invertebrates**	**Freshwater Fish Chronic RQ < 0.01** **Freshwater Invertebrate Chronic RQ = 1.10** At the 21-day or 60-day EEC (1.2 ppb ai/L or 1.08 ppb ai/L, respectively), there is no exceedance of the Chronic Risk LOC for freshwater fish, however there is a marginal exceedance of the Chronic Risk LOC for freshwater invertebrates. This likely underestimates the chronic risk to freshwater invertebrates, as the chronic toxicity endpoint is based on the 10-d midge NOAEC, which does not include reproductive endpoints (which were the most sensitive in the chronic daphnid and mysid studies).
Acute Risk to Estuarine/Marine Fish and Water Column Invertebrates	None	**Estuarine/Marine Fish Acute RQ < 0.01** **Estuarine/Marine Invertebrate Acute RQ = 0.03** At the peak EEC (1.29 ppb ai/L), there are no exceedances of either the Non-listed Species Acute Risk or the Listed Species Acute Risk LOCs for estuarine/marine fish and invertebrates.
Chronic Risk to Estuarine/Marine Fish and Water Column Invertebrates	None	**Estuarine/Marine Fish Chronic RQ < 0.01** **Estuarine/Marine Invertebrate Chronic RQ = 0.24** At the 21-day or 60-day EEC (1.2 ppb ai/L or 1.08 ppb ai/L, respectively), there is no exceedance of the Chronic Risk LOC for estuarine/marine fish or estuarine/marine invertebrates in the water column.
Risk to Aquatic Vascular Plants	None	**Vascular Plant RQs < 0.01** At the peak EEC of 1.29 ppb a.i./L, there are no exceedances of any LOC for vascular plants inhabiting water bodies.
Risk to Aquatic Non-Vascular Plants	None	**Vascular Plant RQs < 0.01** At the peak EEC of 1.29 ppb a.i./L, there are no exceedances of any LOC for non-vascular plants inhabiting water bodies.

4.2 *Risk to Terrestrial Wildlife and Plants*

Risk quotients exceed the acute listed species LOC for birds and mammals and the chronic LOC for mammals under certain exposure scenarios. Risk quotients also exceed the interim listed species LOC for honeybees (LOC = 0.05) and the proposed non-listed species LOC for honeybees (LOC = 0.4). Potential for risk is summarized in **Table 8** below.

TABLE 8. Summary of Environmental Risk Conclusions for Terrestrial Wildlife and Plants		
Assessment Endpoint	**LOC Exceedances**	**Summarized Risk Characterization**
Acute Risk to Birds	**Listed Avian Species**	**Highest Acute Dose-Based RQ = 0.18** **Highest Acute Dietary-Based RQ = 0.01** At the maximum predicted residue levels (Upper Bound Kenaga) and maximum application rate of 2 x 0.2 lbs a.i./L (112 day interval, using 35 day default foliar dissipation half life), the dose-based RQs marginally exceed the listed species LOC for small birds (20g) feeding on short grass and broadleaf plants (RQs for these dietary items range from 0.10 to 0.18). For all other size classes and dietary item combinations, RQs were below 0.09 Dietary-based RQs do not exceed the listed or non-listed species LOC for birds foraging on any dietary item (RQs ≤ 0.01). Based on the RQs and the LD_{50} in the most sensitive acute avian study and using the default slope of 4.5 (95% CI: 2—9), calculations were made to determine the probability that a particular individual would be killed by the maximum concentrations predicted in this assessment. The individual probability of death is 0.04% or 1 in 2,490 birds (95% CI: <0.01%--6.80%).
Chronic Risk to Birds	None	**Highest Chronic RQ = 0.26** At the maximum predicted residue levels (Upper Bound Kenaga) and maximum application rate of 2 x 0.2 lbs a.i./A (112 day interval, using 35 day default foliar dissipation half life), the dietary-based RQs did not exceed the chronic avian LOC (RQs range from 0.10 to 0.26)

TABLE 8. Summary of Environmental Risk Conclusions for Terrestrial Wildlife and Plants		
Assessment Endpoint	**LOC Exceedances**	**Summarized Risk Characterization**
Acute Risk to Mammals	**Listed Mammalian Species**	**Highest Acute RQ = 0.11** At the maximum predicted residue levels (Upper Bound Kenaga) and maximum application rate of 2 x 0.2 lbs a.i./A (112 day interval, using 35 day default foliar dissipation half life), the dose-based RQs marginally exceed the listed species LOC for small and medium mammals feeding on short grass. For all other size classes and dietary items, RQs were below 0.06. Based on the RQs and the LD_{50} in the most sensitive acute mammalian study and using the default slope of 4.5 (95% CI: 2—9), calculations were made to determine the probability that a particular individual would be killed by the maximum concentrations predicted in this assessment. The individual probability of death is < 0.01% or 1 in 125,000 mammals (95% CI: <0.01%--2.76%).
Chronic Risk to Mammals	**Listed and Non-listed Mammalian Species**	**Highest Chronic Dose-Based RQ = 2.36** **Highest Chronic Dietary-Based RQ = 0.27** At the maximum predicted residue levels (Upper Bound Kenaga) and maximum application rate of 2 x 0.2 lbs a.i./A (112 day interval, using 35 day default foliar dissipation half life), the dose-based RQs exceed the LOC for all size classes of mammals feeding on short grass (RQs range from 1.08 to 2.36), small and medium mammals feeding on broadleaf plants (RQs range from 1.13 to 1.33) and small mammals feeding on tall grass (RQ = 1.08). For all other size classes and dietary items, RQs were below 0.92. Dietary-based RQs do not exceed the chronic LOC for mammals.
Non-target Pollinators	**Listed and non-listed Terrestrial Invertebrates**	**RQ based on Dietary Exposure to Adult Bees: 3.07** At the maximum application rate (0.2 lbs a.i/A) and using the Briggs Model for soil applications as described in the 2012 Poolinator Risk Assessment Framework SAP White Paper (USEPA et al., 2012), the adult dietary RQ exceeds both the listed and non-listed species LOCs. Risk to honey bee larval brood cannot be quantitatively evaluated due to a lack of data. Based on the RQs and the LD_{50} in the honey bee acute oral study and using the default slope of 4.5 (95% CI: 2—9), calculations were made to determine the probability that a particular individual would be killed by the maximum dietary concentrations predicted in this assessment. The individual probability of death is 99% or 1 in 1.01 animals (95% CI: 83.3%--100%).

TABLE 8. Summary of Environmental Risk Conclusions for Terrestrial Wildlife and Plants		
Assessment Endpoint	**LOC Exceedances**	**Summarized Risk Characterization**
Terrestrial Plants	None	**Highest RQ < 0.54** For all proposed use patterns, the likelihood of adverse effects on terrestrial plants from clothianidin is considered low (i.e, there were no significant effects on plants in the studies conducted at rates up to 0.19 lb a.i./A/acre). However, this is slightly below the maximum single application rate of 0.2 lb. This may underestimate the risk of clothianidin to terrestrial plants if there is little degradation between multiple applications made at the maximum rate (max RQ would be 1.07 for terrestrial plants in semi-aquatic habitat, assuming 2 applications made at 0.2 lbs a.i./A with no chemical degradation between the applications).

5. ADDITIONAL RISK CHARACTERIZATION/UNCERTAINTIES

Aquatic EECs were determined using the new Surface Water Calculator (SWC), a graphical user interface – GUI – for PRZM-EXAMS, while previous assessments have been conducted using the previous GUI, pe5. The use of SWC decreased aquatic EECs by approximately 40% compared to what they would be had pe5 been used. However, although some conservatism in the risk assessment process may have been lost, it is not likely to affect the results of this risk assessment as RQs either already exceeded the LOC (for freshwater invertebrates in the water column) or were sufficiently below the LOC that more conservative models would still not indicate risk for this use pattern.

RQs determined for chronic risk to benthic estuarine/marine invertebrates and to freshwater invertebrates residing in both the water column and benthic regions may underestimate actual risk due to the lack of chronic estuarine amphipod and midge data. These RQs were based on 10-d studies that could not evaluate reproductive effects. However, in the daphnid and mysid life cycle tests (28-d studies), the reproductive endpoints were the most sensitive.

No passerine acute toxicity data are currently available. If passerines are more sensitive than what the available avian toxicity data indicates, then additional risk could be present to listed and non-listed species beyond what has been identified in this assessment.

The maximum application rate is slightly above the highest rate tested in Tier I terrestrial plant studies. Therefore, risk cannot be quantified in this assessment, but is considered unlikely to either listed or non-listed terrestrial plant species.

For honeybees, the adult dietary RQ was 3.07 using the modified Briggs Model as described in the Pollinator Risk Assessment Framework White Paper (USEPA, 2012). This assumes no degradation between the last possible clothianidin application and bloom. Even if the minimum soil aerobic metabolism half life is used (178 days) and the maximum time between the last possible application date (October 31st) and the likely latest possible bloom time (March 31, resulting in 150 days between latest application and bloom), the RQ would still exceed both the non-listed and listed species LOC (RQ ~ 1.5). If no degradation is assumed between the two clothianidin applications (this effectively represents the worst case soil aerobic metabolism half life of 1155 days), than the RQ would be 6.14

Dietary effects to honeybee larval brood were not evaluated due to a lack of data, however larvae would need to be approximately 3 times less sensitive than adult bees in order not to exceed the non-listed species LOC (0.4) and 25 times less sensitive than adult bees in order not to exceed the listed species LOC.

A refined assessment of the risks to honey bees would use empirical pollen and nectar data from soil applications of clothianidin to further characterize potential risks to honey bees and other pollinators. Although acceptable data are currently not available, attached to the emergency petition submission the Registrant, Valent, submitted a study evaluating residues of clothianidin and its degradates TZNG and TZMU in citrus nectar following soil applications (MRID 49317901, currently in review). This study examined citrus nectar concentrations following one application of clothianidin at 0.2 lb a.i./A (0.0013 lb a.i./tree assuming 150 trees/acre) in February, 2012 or one application at 6 different soil treatment dates prior to the 2013 citrus bloom in late 2012 and early 2013.

The study author reported that after the February 2012 application, 2012 citrus nectar samples (collected 21 days after treatment or DAT) contained clothianidin residues ranging from 3.1 to 18.7 ppb. Residues in nectar samples (collected 18-19 DAT) after the February 2013 application were reported to range from 0.4—11.4 ppb. Residues in nectar samples collected 40--47 DAT were reported to range from 0.78—8.5 ppb. Nectar samples collected 74—77 DAT reportedly ranged from 1.3—8.0 ppb. Nectar samples collected 109—116 DAT were reported to range from 0.48 to 9.3 ppb. Nectar samples collected 139—146 DAT were reported to range from <LOD to 13.2 ppb. Nectar samples collected 173-174 DAT were reported to range from 0.48—3.1 ppb.

Following the proposed label directions (no applications later than October 31), the most similar treatment profile would be the November application window (bloom nectar samples collected 109—116 DAT). As mentioned above, residues in this sample ranged from 0.48 to 9.3ppb with a mean of 2.70 ppb (n = 7). Using the maximum value during this time period of 9.3 ppb in place of the Briggs Model estimate would still result in an exceedance of the non-listed species LOC (RQ = 0.73), while using the mean value of 2.70 ppb would only result in an exceedance of the listed species LOC (RQ = 0.21). This study only evaluated concentrations in nectar. If concentrations in citrus pollen are considerably higher than the reported nectar concentrations, than risk to adult bees may be higher. In the Emergency Exemption Request submission materials (dated February 18, 2014), the Florida Department of Agriculture and Consumer Services (FDACS) states that citrus pollen is not a preferred pollen source for honeybees. However, no data supporting this was submitted with the petition and if few other plants are flowering at the time and location when and where citrus plants are blooming, honeybees may harvest and use citrus pollen.

According to the FDACS section 18 submission, of the total commercial citrus tree crop grown in Florida, only 7.2% would be bearing trees 3-5 years old that could be treated under the specific exemption. FDACS also has developed an online mapping tool for beekeepers to register the approximate location of hives near citrus and facilitate communication between beekeepers and growers. The mapping tool includes the location of citrus groves planted in the past 5 years, which may assist beekeepers who use the tool to avoid use sites covered under this Section 18. However, EFED has not reviewed the mapping tool for accuracy and beekeeper adoption of its use is currently unknown.

This study only evaluated one application of clothianidin, while the label permits a second one at least 4 months previous to the October 31st final application date, which may increase residues at the time of citrus bloom slightly. Additionally, according to the supplemental materials submitted in the petition, the strategy for managing the Asian Citrus Psyllid requires the application of a soil-applied neonicotinoid every 6-8 weeks. Since these chemicals have similar modes of action, it is possible that this risk assessment underestimates risk since it does not consider these chemicals cumulatively and due to the relatively long half lives of these compounds, residues are likely to accumulate prior to the final application date before bloom.

6. SUMMARY--INCIDENT ANALYSIS

A review on March 20, 2014 of the Ecological Incident Information System (EIIS, version 2.1.1), which is maintained by the Agency's Office of Pesticide Programs, indicates a total of 22 reported ecological incidents in the United States associated with the use of clothianidin. (These incidents are summarized in **Table 9**. All of the incidents associated with clothianidin use that are recorded in EIIS occurred between 2010 and 2013 with the majority (59%) reported in 2012. All of the incidents involved managed honey bees. The certainty categories[1] regarding the likelihood that the use of clothianidin caused the 22 incidents ranged from unrelated (1 instance) to unlikely (1 incident), possible (5 incidents), probable (12 incidents) to highly probable (3 incidents). Five of the incidents were considered to be associated with registered uses of clothianidin at the time of the incident, but the legality of use (*e.g.*, accidental or intentional misuse) was not determined in 16 (73%) of the reported incidents and one incident was considered a misuse. Eight of the incidents involved additional chemicals besides clothianidin in some cases with concentrations that are orders of magnitude higher for some of the chemicals. In the incidents where clothianidin was considered probable or highly probable to have resulted in the incident, clothianidin residues were reported in 11 of the 15 incidents in this category with residues ranging from the LOD (Level of Detection) to 400 ppb in dead bee samples and several thousand ppb in foliage samples. 20 of the reported incidents for clothianidin involved two uses that are currently registered (corn, cotton), and the remaining two incidents did not have a use site specified.

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1 The Ecological Incident Information System (EIIS) used by EPA to store incident data relies on the following certainty indices:

- **Definite**: (residues detected in affected organisms and other lines of evidence support cause)
- **Probable:** (residues were not measured or the measured residues were not sufficient to be considered toxic, but pesticide was used in close proximity and would be capable of exerting such an effect)
- **Possible**: multiple pesticides were used in close proximity and any of them are capable of causing such an effect.
- **Unlikely:** there are no measured residues and the observed effects are not consistent with those caused by pesticides used in the area or there was no pesticide use known in the area.
- **Unrelated:** effects observed in the incident are unrelated to pesticide use.

In cases where entire colonies were affected, it is uncertain whether the colony-level effect was due directly to pesticide exposure, whether it was indirectly due to pesticide exposure (*e.g.*, large losses of forage bees from pesticide exposure leading to the colony being more susceptible to disease and/or starvation), or whether the effect was not related to pesticides at all but was the result of disease and/or starvation. While the majority (77%) of beekill incidents reported in **Table 9** were associated with corn, there is uncertainty whether insecticides and in particular clothianidin was in use since residues were either not measured or were not detected in several of these beekills. Additionally, there were several other incidents (not included in **Table 9)** that occurred in 2012 around the time of corn planting, but formal investigations of these incidents have not yet revealed any residues of clothianidin or other neonicotinoid insecticides.

Table 9: Ecological Incidents in the U.S. Associated with Clothianidin

Incident Number	Taxa Involved	Magnitude	Year	Location	Use	Legality of Use	Certainty Code	Residues (ppb)	Other Chemicals Involved[1]
I023902-001	Honeybee	33 colonies affected	2012	IN	Corn	UN	3	2.5-3.1 in bees	N/A
I024270-001	Honeybee	48 colonies affected	2012	NY	Corn	UN	3	400 in bees 2 in foliage	Phosmet-3 Thiacloprid-2 Cyhalothrin-2 Captan-1 Cyprodinil-1 Glyphosate-1 Acetamiprid-1 Ethofumesate-1 Fenbuconazole-1 Methoxyfenozide-1
I022743-001	Honeybee	65 colonies lost	2010	PA	Corn	UN	2	N/A	N/A
I022340-001	Honeybee	4 apiaries affected	2010	IN	Corn	UN	3	5-21 in larval bees	Thiamethoxam-2 Pendimethalin-1 Imidacloprid-1 Atrazine-1 Simazine-1 Metolachlor-1 Trifloxystrobin-1 Coumaphos-1
I024495-001	Honeybee	N/A	2012	IN	Corn	RU	3	3.4 in bees	N/A
I024495-003	Honeybee	N/A	2012	IN	Corn	RU	3	Detected in pollen, hives, and bees.	N/A
I024995-002	Honeybee	N/A	2012	IN	Corn	RU	3	3.5 in bees	N/A
I024495-004	Honeybee	N/A	2012	IN	Corn	UN	3	2.5-3.1 in bees	N/A
I024495-005	Honeybee	22 hives affected	2012	IN	N/A	UN	3	2.5 in bees	N/A

Incident Number	Taxa Involved	Magnitude	Year	Location	Use	Legality of Use	Certainty Code	Residues (ppb)	Other Chemicals Involved[1]
I024004-001	Honeybee	30 colonies affected	2012	IA	Corn	UN	1	<LOD in foliage	Imidacloprid-1
I024702-001	Honeybee	> 100 bees	2012	IN	Corn	RU	4	3.3 in bees	N/A
I025031-001	Honeybee	N/A	2012	SD	Corn	RU	2	N/A	N/A
I022757-001	Honeybee	1250 dead bees	2011	PA	Corn	UN	2	N/A	N/A
I022342-001	Honeybee	N/A	2010	MN	Corn	UN	2	N/A	N/A
I023967-001	Honeybee	1346 hives affected	2012	MN	Corn	UN	3	N/A	Thiamethoxam-3 Metalaxyl-2 Fludioxonil-1 Thiabendazole-1 Azoxystrobin-1
I024221-001	Honeybee	N/A	2012	AZ	Cot-ton	UN	3	N/A	Bifenthrin-3
I025875-001	Honeybee	N/A	2013	IN	N/A	UN	0	N/A	<LOD
I025271-001	Honeybee	200 hives affected	2013	MN	Corn	M	4	3.58—4.99 in bees	Thiamethoxam-4
I025675-001	Honeybee	N/A	2013	GA	Cot-ton	UN	3	N/A	N/A
I024877-001	Honeybee	120 hives	2012	AZ	Cot-ton	UN	3	5-360 in bees	Fluvalinate-3 Acetamiprid-2 DDT-0 Flonicamid-0
I025176-001	Honeybee	Thous-ands of bees	2013	MN	Corn	UN	4	41,700 in foliage	Thiamethoxam-4
I025653-001	Honeybee	18 hives	2013	NY	Corn	UN	2	N/A	N/A

Certainty Code: 0 = Unrelated, 1 = Unlikely, 2 = Possible, 3 = Probable, 4 = Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse(Accidental), MI=Misuse(Intentional), UN=Unknown.
[1] The number after the chemical indicates the certainty that the chemical contributed to the incident following the certainty code listings indicated above.

7. SUMMARY – LISTED SPECIES (Direct and Indirect Effects)

Based on estimated maximum application rates, exposure levels and available effects data, clothianidin use on citrus in Florida may lead to direct adverse effects on listed freshwater invertebrates residing in the water column from acute and chronic exposures, direct adverse affects on listed birds and mammals from acute and chronic dose-based exposure, and direct adverse effects on listed insect pollinators feeding on citrus nectar and pollen.
There is a potential for indirect effects to listed animal and plant taxa that depend on those taxa directly at risk when exposed to clothianidin as pollinators or seed dispersers, mammal or reptile burrows for habitat, feeding, or cover requirements, and for survival, growth, or reproduction. Listed taxa potentially at risk from direct or indirect effects from exposure to clothianidin are

presented in **Table 10**. Listed species potentially impacted by the proposed use of clothianidin are presented in **Appendix A**.

Table 10. Potential listed species risks associated with direct or indirect effects due to the use of clothianidin on citrus in Florida.			
Listed Taxon	**Direct Effects from Acute Exposures**	**Direct Effects from Chronic Exposures**	**Indirect Effects[2]**
Aquatic			
Aquatic non-vascular plants	No	No	Yes
Aquatic vascular plants	No	No	Yes
Freshwater invertebrates	**Yes**	**Yes**	Yes
Marine/estuarine invertebrates	No	No	Yes
Freshwater fish	No	No	Yes
Marine/estuarine fish	No	No	Yes
Aquatic-phase amphibians	No	No	Yes
Terrestrial			
Terrestrial plants – monocots	No	N/A	Yes
Terrestrial plants - dicots	No	N/A	Yes
Insects	**Yes**	**Yes**	Yes
Birds	**Yes**	**Yes**	Yes
Terrestrial-phase amphibians	**Yes**	**Yes**	Yes
Reptiles	**Yes**	**Yes**	Yes
Mammals	**Yes**	**Yes**	Yes

N/A – Not applicable

[1]Risk presumed due to lack of data.

[2]Indirect effects cannot be ruled out until an ESA assessment has been completed.

8. REFERENCES

U.S. Environmental Protection Agency. 2004. IEC (v1.1). Individual Effects Chance Model. Environmental Fate and Effects Division, Office of Pesticide Programs. US EPA. Washington, DC. June 22, 2004

U.S. Environmental Protection Agency, Pest Management Regulatory Agency, Californial Department of Pesticide Regulation. 2012. White Paper in Support of the Proposed Risk Assessment Process for Bees. Submitted to the FIFRA Scientific Advisory Panel for Review and Comment. Environmental Fate and Effects Division, Office of Pesticide Programs, USEPA. Washington, D.C. September 11, 2012.

Appendix A: Summary of LOCATES Endangered Species Run

County Occurrence List by State and Taxa

Minimum of 1 Acre

All Medium Types Included

Amphibian, Arachnid, Bird, Bivalve, Conf/cycds, Coral, Crustacean, Dicot, Ferns, Fish, Gastropod, Insect, Lichen, Mammal, Monocot, Reptile

limes, citron, citrus fruit-all, grapefruit, kumquats, lemons, lemons and limes, oranges-all, tangelos, tangerines

104 Species

Florida

Amphibian

Frosted Flatwoods salamander
Ambystoma cingulatum

Baker
Jefferson
Wakulla

Reticulated flatwoods salamander
Ambystoma bishopi

Escambia
Holmes
Jackson
Okaloosa
Santa Rosa
Walton
Washington

Bird

Audubon's crested caracara
Polyborus plancus audubonii

Brevard
Broward
Charlotte
Collier
DeSoto
Glades
Hardee
Hendry
Highlands
Hillsborough
Indian River
Lee
Manatee
Martin
Miami-Dade
Okeechobee

Bird

Orange
Osceola
Palm Beach
Polk
Sarasota
St. Lucie

Bachman's warbler (=wood)
Vermivora bachmanii

Miami-Dade

Cape Sable seaside sparrow
Ammodramus maritimus mirabilis

Collier
Miami-Dade

Everglade snail kite
Rostrhamus sociabilis plumbeus

Brevard
Broward
Collier
Glades
Hendry
Highlands
Indian River
Lee
Martin
Miami-Dade
Okeechobee
Orange
Osceola
Palm Beach
Polk
St. Lucie

Florida grasshopper sparrow
Ammodramus savannarum floridanus

DeSoto
Glades

Bird

Highlands
Okeechobee
Osceola
Polk

Florida scrub-jay
Aphelocoma coerulescens

Brevard
Charlotte
Citrus
Clay Collier
DeSoto
Flagler
Glades
Hardee
Hendry
Hernando
Highlands
Hillsborough
Indian River
Lake
Lee Levy
Manatee
Marion
Martin
Okeechobee
Orange
Osceola
Palm Beach
Pasco
Pinellas
Polk
Putnam
Sarasota

Bird

Seminole
St. Lucie
Volusia

Kirtland's Warbler
Dendroica kirtlandii

Collier
Martin
Miami-Dade
Palm Beach
St. Lucie

Piping Plover
Charadrius melodus

Charlotte
Collier
Escambia
Indian River
Lee
Martin
Miami-Dade
Okaloosa
Palm Beach
Santa Rosa
Sarasota
St. Lucie
Wakulla
Walton

Red-cockaded woodpecker
Picoides borealis

Charlotte
Collier
Escambia
Glades
Hendry
Highlands
Holmes
Jackson
Jefferson
Lee
Okaloosa
Osceola
Palm Beach
Polk
Santa Rosa
St. Lucie

Bird

Wakulla
Walton
Washington

Wood stork
Mycteria americana

Alachua
Baker
Bradford
Brevard
Broward
Charlotte
Citrus
Clay
Collier
Columbia
DeSoto
Duval
Escambia
Flagler
Gilchrist
Glades
Hamilton
Hardee
Hendry
Hernando
Highlands
Hillsborough
Holmes
Indian River
Jackson
Jefferson
Lake
Lee Levy
Madison
Manatee
Marion
Martin
Miami-Dade
Nassau
Okaloosa
Okeechobee
Orange
Osceola

Bird

Palm Beach
Pasco
Pinellas
Polk
Putnam
Santa Rosa
Sarasota
Seminole
St. Johns
St. Lucie
Sumter
Suwannee
Taylor
Volusia
Wakulla
Walton
Washington

Bivalve

Chipola slabshell
Elliptio chipolaensis

Jackson

Choctaw bean
Villosa choctawensis

Escambia
Holmes
Okaloosa
Santa Rosa
Walton
Washington

Fat three-ridge (mussel)
Amblema neislerii

Jackson

Fuzzy pigtoe
Pleurobema strodeanum

Escambia
Holmes
Jackson
Okaloosa
Santa Rosa
Walton
Washington

Gulf moccasinshell
Medionidus penicillatus

Jackson

Bivalve

Washington

Narrow pigtoe
Fusconaia escambia

Escambia
Okaloosa
Santa Rosa

Ochlockonee moccasinshell
Medionidus simpsonianus

Wakulla

Oval pigtoe
Pleurobema pyriforme

Alachua
Bradford
Jackson
Wakulla
Washington

Purple bankclimber (mussel)
Elliptoideus sloatianus

Jackson
Wakulla

Round Ebonyshell
Fusconaia rotulata

Escambia
Santa Rosa

Shinyrayed pocketbook
Lampsilis subangulata

Jackson
Wakulla

Southern kidneyshell
Ptychobranchus jonesi

Walton
Washington

Southern sandshell
Hamiota (=Lampsilis) australis

Holmes
Jackson
Okaloosa
Walton
Washington

Tapered pigtoe
Fusconaia burkei

Holmes
Jackson
Walton

Bivalve

Washington

Conf/cycds

Florida torreya
Torreya taxifolia

Jackson

Coral

Elkhorn coral
Acropora palmata

Miami-Dade

Staghorn coral
Acropora cervicornis

Broward
Miami-Dade
Palm Beach

Crustacean

Squirrel Chimney Cave shrimp
Palaemonetes cummingi

Alachua

Dicot

Aboriginal Prickly-apple
Harrisia aboriginum

Charlotte
Lee
Sarasota

Avon Park harebells
Crotalaria avonensis

Highlands
Polk

Beach jacquemontia
Jacquemontia reclinata

Broward
Miami-Dade
Palm Beach

Beautiful pawpaw
Deeringothamnus pulchellus

Charlotte
Lee
Orange

Brooksville bellflower
Campanula robinsiae

Hernando
Hillsborough

Dicot

Cape Sable Thoroughwort
Chromolaena frustrata

Miami-Dade

Carter's mustard
Warea carteri

Glades
Highlands
Polk

Chapman rhododendron
Rhododendron chapmanii

Clay

Cooley's meadowrue
Thalictrum cooleyi

Walton

Cooley's water-willow
Justicia cooleyi

Hernando
Sumter

Crenulate lead-plant
Amorpha crenulata

Miami-Dade

Deltoid spurge
Chamaesyce deltoidea ssp. deltoi

Miami-Dade

Etonia rosemary
Conradina etonia

Putnam

Florida bonamia
Bonamia grandiflora

Hardee
Highlands
Hillsborough
Lake
Manatee
Marion
Orange
Osceola
Polk
Sarasota

Florida golden aster
Chrysopsis floridana

Hardee
Hillsborough
Manatee

Dicot

Pinellas

Florida Semaphore Cactus
Consolea corallicola

Miami-Dade

Florida ziziphus
Ziziphus celata

Highlands
Polk

Four-petal pawpaw
Asimina tetramera

Martin
Palm Beach

Fragrant prickly-apple
Cereus eriophorus var. fragrans

Indian River
St. Lucie

Fringed campion
Silene polypetala

Jackson

Garber's spurge
Chamaesyce garberi

Miami-Dade

Garrett's mint
Dicerandra christmanii

Highlands

Gentian pinkroot
Spigelia gentianoides

Jackson
Washington

Godfrey's butterwort
Pinguicula ionantha

Wakulla

Highlands scrub hypericum
Hypericum cumulicola

Highlands
Polk

Lakela's mint
Dicerandra immaculata

Indian River
Martin
St. Lucie

Lewton's polygala
Polygala lewtonii

Highlands

Dicot

Osceola
Polk

Longspurred mint
Dicerandra cornutissima

Marion

Miccosukee gooseberry
Ribes echinellum

Jefferson

Okeechobee gourd
Cucurbita okeechobeensis ssp. okeechobeensis

Broward
Glades
Lake
Miami-Dade
Palm Beach
Volusia

Papery whitlow-wort
Paronychia chartacea

Highlands
Jackson
Lake
Orange
Osceola
Polk
Washington

Pigeon wings
Clitoria fragrans

Highlands
Polk

Pygmy fringe-tree
Chionanthus pygmaeus

DeSoto
Highlands
Osceola
Polk
Sarasota

Rugel's pawpaw
Deeringothamnus rugelii

Volusia

Sandlace
Polygonella myriophylla

Highlands
Osceola

Dicot

Polk

Scrub blazingstar
Liatris ohlingerae

Highlands
Polk

Scrub buckwheat
Eriogonum longifolium var. gnaphalifolium

Highlands
Lake
Marion
Orange
Osceola
Polk

Scrub lupine
Lupinus aridorum

Orange
Osceola
Polk

Scrub mint
Dicerandra frutescens

Highlands
Polk

Scrub plum
Prunus geniculata

Highlands
Lake
Orange
Osceola
Polk

Short-leaved rosemary
Conradina brevifolia

Highlands
Polk

Small's milkpea
Galactia smallii

Miami-Dade

Snakeroot
Eryngium cuneifolium

Highlands

Tiny polygala
Polygala smallii

Broward
Martin

Dicot

Miami-Dade
Palm Beach
St. Lucie

Wide-leaf warea
Warea amplexifolia

Lake
Orange
Osceola
Polk

Wireweed
Polygonella basiramia

Highlands
Polk

Fish

Gulf sturgeon
Acipenser oxyrinchus desotoi

Charlotte
Collier
Columbia
Escambia
Gilchrist
Hamilton
Holmes
Jackson
Jefferson
Lee
Levy
Madison
Okaloosa
Santa Rosa
Sarasota
Suwannee
Wakulla
Walton
Washington

Okaloosa darter
Etheostoma okaloosae

Okaloosa
Walton

Smalltooth sawfish
Pristis pectinata

Broward
Charlotte
Collier

Fish

Indian River
Lee
Martin
Miami-Dade
Palm Beach
Sarasota
St. Lucie

Gastropod

Stock Island tree snail
Orthalicus reses (not incl. nesodryas)

Miami-Dade

Insect

Miami Blue Butterfly
Cyclargus (=Hemiargus) thomasi bethunebakeri

Miami-Dade

Schaus swallowtail butterfly
Heraclides aristodemus ponceanus

Miami-Dade

Lichen

Florida perforate cladonia
Cladonia perforata

Escambia
Highlands
Manatee
Martin
Okaloosa
Palm Beach
Polk
Santa Rosa

Mammal

Anastasia Island beach mouse
Peromyscus polionotus phasma

St. Johns

Choctawhatchee beach mouse
Peromyscus polionotus allophrys

Okaloosa
Walton

Florida panther
Puma (=Felis) concolor coryi

Broward
Charlotte
Collier

Mammal

DeSoto
Glades
Hardee
Hendry
Highlands
Lee
Miami-Dade
Okeechobee
Osceola
Palm Beach
Polk
Sarasota

Florida salt marsh vole
Microtus pennsylvanicus dukecampbelli

Levy

Gray bat
Myotis grisescens

Holmes
Jackson
Washington

Indiana bat
Myotis sodalis

Jackson

Perdido Key beach mouse
Peromyscus polionotus trissylleps

Escambia

Southeastern beach mouse
Peromyscus polionotus niveiventr

Brevard
Broward
Indian River
Martin
Palm Beach
St. Lucie
Volusia

West Indian Manatee
Trichechus manatus

Brevard
Broward
Charlotte
Citrus
Clay
Collier

Mammal DeSoto

Duval
Escambia
Flagler
Glades
Hendry
Hernando
Highlands
Hillsborough
Indian River
Jefferson
Lake
Lee Levy
Manatee
Marion
Martin
Miami-Dade
Nassau
Okaloosa
Okeechobee
Osceola
Palm Beach
Pasco
Pinellas
Putnam
Santa Rosa
Sarasota
Seminole
St. Johns
St. Lucie
Taylor
Volusia
Wakulla
Walton

Monocot

Britton's beargrass
Nolina brittoniana

Highlands
Lake
Marion
Orange
Osceola
Polk

Monocot

Johnson's seagrass
Halophila johnsonii

Broward
Indian River
Martin
Miami-Dade
Palm Beach
St. Lucie

Reptile

American crocodile
Crocodylus acutus

Broward
Charlotte
Collier
Indian River
Lee
Martin
Miami-Dade
Palm Beach
St. Lucie

Atlantic salt marsh snake
Nerodia clarkii taeniata

Brevard
Indian River
Volusia

Bluetail mole skink
Eumeces egregius lividus

Highlands
Osceola
Polk

Eastern indigo snake
Drymarchon corais couperi

Alachua
Brevard
Broward
Charlotte
Citrus
Clay
Collier
Columbia
DeSoto
Duval
Escambia
Gilchrist

Reptile Glades

Hamilton
Hardee
Hendry
Hernando
Highlands
Hillsborough
Holmes
Indian River
Jackson
Jefferson
Lake
Lee Levy
Madison
Manatee
Marion
Martin
Miami-Dade
Nassau
Okaloosa
Okeechobee
Orange
Osceola
Palm Beach
Pasco
Pinellas
Polk
Putnam
Santa Rosa
Sarasota
Seminole
St. Johns
St. Lucie
Sumter
Suwannee
Taylor
Volusia
Wakulla
Walton
Washington

Green sea turtle
Chelonia mydas

Brevard

Reptile Broward

Charlotte
Collier
Duval
Escambia
Flagler
Hillsborough
Indian River
Lee
Manatee
Martin
Miami-Dade
Nassau
Okaloosa
Palm Beach
Pinellas
Santa Rosa
Sarasota
St. Johns
St. Lucie
Volusia
Walton

Hawksbill sea turtle
Eretmochelys imbricata

Brevard
Broward
Charlotte
Collier Duval
Escambia
Flagler
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Indian River
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Okaloosa
Palm Beach
Pinellas
Santa Rosa
Sarasota
St. Johns

Reptile

St. Lucie
Volusia
Walton

Kemp's ridley sea turtle
Lepidochelys kempii

Escambia
Lee
Okaloosa
Santa Rosa
Walton

Leatherback sea turtle
Dermochelys coriacea

Brevard
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St. Johns
St. Lucie
Volusia
Walton

Loggerhead sea turtle
Caretta caretta

Escambia
Jefferson
Okaloosa
Santa Rosa
Wakulla
Walton

Reptile

Sand skink
Neoseps reynoldsi

Highlands
Lake
Marion
Orange
Osceola
Polk
Putnam

Species List

Aboriginal Prickly-apple (Harrisia aboriginum)		Dicot
Florida Semaphore Cactus (Consolea corallicola)		Dicot
Florida salt marsh vole (Microtus pennsylvanicus dukecampbelli)	Brackish	Mammal
Anastasia Island beach mouse (Peromyscus polionotus phasma)	Coastal	Mammal
Choctawhatchee beach mouse (Peromyscus polionotus allophrys)	Coastal	Mammal
Perdido Key beach mouse (Peromyscus polionotus trissyllepsis)	Coastal	Mammal
Southeastern beach mouse (Peromyscus polionotus niveiventris)	Coastal	Mammal
Hawksbill sea turtle (Eretmochelys imbricata)	Coastal/Saltwater	Reptile
Johnson's seagrass (Halophila johnsonii)	Coastal/Saltwater	Monocot
Kemp's ridley sea turtle (Lepidochelys kempii)	Coastal/Saltwater	Reptile
Loggerhead sea turtle (Caretta caretta)	Coastal/Saltwater	Reptile
American crocodile (Crocodylus acutus)	Freshwater	Reptile
Chipola slabshell (Elliptio chipolaensis)	Freshwater	Bivalve
Choctaw bean (Villosa choctawensis)	Freshwater	Bivalve
Fat three-ridge (mussel) (Amblema neislerii)	Freshwater	Bivalve
Fuzzy pigtoe (Pleurobema strodeanum)	Freshwater	Bivalve
Gulf moccasinshell (Medionidus penicillatus)	Freshwater	Bivalve
Narrow pigtoe (Fusconaia escambia)	Freshwater	Bivalve
Ochlockonee moccasinshell (Medionidus simpsonianus)	Freshwater	Bivalve
Okaloosa darter (Etheostoma okaloosae)	Freshwater	Fish

Oval pigtoe (Pleurobema pyriforme)	Freshwater	Bivalve
Purple bankclimber (mussel) (Elliptoideus sloatianus)	Freshwater	Bivalve
Reticulated flatwoods salamander (Ambystoma bishopi)	Freshwater	Amphibian
Round Ebonyshell (Fusconaia rotulata)	Freshwater	Bivalve
Shinyrayed pocketbook (Lampsilis subangulata)	Freshwater	Bivalve
Southern kidneyshell (Ptychobranchus jonesi)	Freshwater	Bivalve
Southern sandshell (Hamiota (=Lampsilis) australis)	Freshwater	Bivalve
Squirrel Chimney Cave shrimp (Palaemonetes cummingi)	Freshwater	Crustacean
Tapered pigtoe (Fusconaia burkei)	Freshwater	Bivalve
Frosted Flatwoods salamander (Ambystoma cingulatum)	Freshwater/Vernal Pool	Amphibian
Elkhorn coral (Acropora palmata)	Saltwater	Coral
Green sea turtle (Chelonia mydas)	Saltwater	Reptile
Staghorn coral (Acropora cervicornis)	Saltwater	Coral
West Indian Manatee (Trichechus manatus)	Saltwater	Mammal
Atlantic salt marsh snake (Nerodia clarkii taeniata)	Saltwater/Brackish	Reptile
Smalltooth sawfish (Pristis pectinata)	Saltwater/Brackish	Fish
Leatherback sea turtle (Dermochelys coriacea)	Saltwater/Coastal	Reptile
Gulf sturgeon (Acipenser oxyrinchus desotoi)	Saltwater/Freshwater	Fish
Gray bat (Myotis grisescens)	Subterraneous	Mammal
Audubon's crested caracara (Polyborus plancus audubonii)	Terrestrial	Bird
Bachman's warbler (=wood) (Vermivora bachmanii)	Terrestrial	Bird
Bluetail mole skink (Eumeces egregius lividus)	Terrestrial	Reptile
Cape Sable seaside sparrow (Ammodramus maritimus mirabilis)	Terrestrial	Bird

Cape Sable Thoroughwort (Chromolaena frustrata)	Terrestrial	Dicot
Eastern indigo snake (Drymarchon corais couperi)	Terrestrial	Reptile
Everglade snail kite (Rostrhamus sociabilis plumbeus)	Terrestrial	Bird
Florida grasshopper sparrow (Ammodramus savannarum floridanus)	Terrestrial	Bird
Florida panther (Puma (=Felis) concolor coryi)	Terrestrial	Mammal
Florida scrub-jay (Aphelocoma coerulescens)	Terrestrial	Bird
Indiana bat (Myotis sodalis)	Terrestrial	Mammal
Kirtland's Warbler (Dendroica kirtlandii)	Terrestrial	Bird
Miami Blue Butterfly (Cyclargus (=Hemiargus) thomasi bethunebakeri)	Terrestrial	Insect
Piping Plover (Charadrius melodus)	Terrestrial	Bird
Red-cockaded woodpecker (Picoides borealis)	Terrestrial	Bird
Sand skink (Neoseps reynoldsi)	Terrestrial	Reptile
Schaus swallowtail butterfly (Heraclides aristodemus ponceanus)	Terrestrial	Insect
Stock Island tree snail (Orthalicus reses (not incl. nesodryas))	Terrestrial	Gastropod
Wood stork (Mycteria americana)	Terrestrial	Bird
Avon Park harebells (Crotalaria avonensis)	Unattributed Wetland Status	Dicot
Beach jacquemontia (Jacquemontia reclinata)	Unattributed Wetland Status	Dicot
Britton's beargrass (Nolina brittoniana)	Unattributed Wetland Status	Monocot
Carter's mustard (Warea carteri)	Unattributed Wetla	Dicot
Crenulate lead-plant (Amorpha crenulata)	Unattributed Wetland Status	Dicot
Deltoid spurge (Chamaesyce deltoidea ssp. deltoidea)	Unattributed Wetland Status	Dicot
Etonia rosemary (Conradina etonia)	Unattributed Wetland Status	Dicot
Florida bonamia (Bonamia grandiflora)	Unattributed Wetland Status	Dicot

Florida golden aster (Chrysopsis floridana)	Unattributed Wetland Status	Dicot
Florida perforate cladonia (Cladonia perforata)	Unattributed Wetland Status	Lichen
Florida torreya (Torreya taxifolia)	Unattributed Wetla	Conf/cycds
Florida ziziphus (Ziziphus celata)	Unattributed Wetla	Dicot
Four-petal pawpaw (Asimina tetramera)	Unattributed Wetland Status	Dicot
Fragrant prickly-apple (Cereus eriophorus var. fragrans)	Unattributed Wetland Status	Dicot
Fringed campion (Silene polypetala)	Unattributed Wetland Status	Dicot
Garber's spurge (Chamaesyce garberi)	Unattributed Wetland Status	Dicot
Garrett's mint (Dicerandra christmanii)	Unattributed Wetland Status	Dicot
Gentian pinkroot (Spigelia gentianoides)	Unattributed Wetland Status	Dicot
Highlands scrub hypericum (Hypericum cumulicola)	Unattributed Wetland Status	Dicot
Lakela's mint (Dicerandra immaculata)	Unattributed Wetland Status	Dicot
Lewton's polygala (Polygala lewtonii)	Unattributed Wetland Status	Dicot
Longspurred mint (Dicerandra cornutissima)	Unattributed Wetland Status	Dicot
Okeechobee gourd (Cucurbita okeechobeensis ssp. okeechobeensis)	Unattributed Wetland Status	Dicot
Papery whitlow-wort (Paronychia chartacea)	Unattributed Wetland Status	Dicot
Pigeon wings (Clitoria fragrans)	Unattributed Wetla	Dicot
Pygmy fringe-tree (Chionanthus pygmaeus)	Unattributed Wetland Status	Dicot
Sandlace (Polygonella myriophylla)	Unattributed Wetland Status	Dicot
Scrub blazingstar (Liatris ohlingerae)	Unattributed Wetland Status	Dicot
Scrub buckwheat (Eriogonum longifolium var. gnaphalifolium)	Unattributed Wetland Status	Dicot
Scrub lupine (Lupinus aridorum)	Unattributed Wetla	Dicot
Scrub mint (Dicerandra frutescens)	Unattributed Wetland Status	Dicot
Scrub plum (Prunus geniculata)	Unattributed Wetla	Dicot

Short-leaved rosemary (Conradina brevifolia)	Unattributed Wetland Status	Dicot
Small's milkpea (Galactia smallii)	Unattributed Wetla	Dicot
Snakeroot (Eryngium cuneifolium)	Unattributed Wetla	Dicot
Wide-leaf warea (Warea amplexifolia)	Unattributed Wetland Status	Dicot
Wireweed (Polygonella basiramia)	Unattributed Wetla	Dicot
Beautiful pawpaw (Deeringothamnus pulchellus)	Wetland	Dicot
Brooksville bellflower (Campanula robinsiae)	Wetland	Dicot
Chapman rhododendron (Rhododendron chapmanii)	Wetland	Dicot
Cooley's meadowrue (Thalictrum cooleyi)	Wetland	Dicot
Cooley's water-willow (Justicia cooleyi)	Wetland	Dicot
Godfrey's butterwort (Pinguicula ionantha)	Wetland	Dicot
Miccosukee gooseberry (Ribes echinellum)	Wetland	Dicot
Rugel's pawpaw (Deeringothamnus rugelii)	Wetland	Dicot
Tiny polygala (Polygala smallii)	Wetland	Dicot

No species were selected for exclusion.

Marine Species

Coral (Anthozoa)

Common name	Scientific name	Family	Order
Elkhorn coral	*Acropora palmata*	Acroporidae	Scleractinia
Staghorn coral	*Acropora cervicornis*	Acroporidae	Scleractinia

Fish (Actinopterygii)

Common name	Scientific name	Family	Order
Atlantic salmon	*Salmo salar*	Salmonidae	Salmoniformes
Chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	Salmonidae	Salmoniformes
Coho salmon	*Oncorhynchus (=Salmo) kisutch*	Salmonidae	Salmoniformes
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Acipenseridae	Acipenseriformes
North American green sturgeon	*Acipenser medirostris*	Acipenseridae	Acipenseriformes
Rockfish, Bocaccio	*Sebastes paucispinis*	Scorpaenidae	Perciformes
Rockfish, Canary	*Sebastes pinniger*	Scorpaenidae	Perciformes
Shortnose sturgeon	*Acipenser brevirostrum*	Acipenseridae	Acipenseriformes
Smalltooth sawfish	*Pristis pectinata*	Pristidae	Pristiformes
Sockeye salmon	*Oncorhynchus (=Salmo) nerka*	Salmonidae	Salmoniformes

Fish (Actinopterygii)

Common name	Scientific name	Family	Order
Steelhead	*Oncorhynchus (=Salmo) mykiss*	Salmonidae	Salmoniformes
White sturgeon	*Acipenser transmontanus*	Acipenseridae	Acipenseriformes

Gastropod (Gastropoda)

Common name	Scientific name	Family	Order
Abalone, Black	*Haliotis cracherodii*	Haliotidae	Vetigastropoda
White Abalone	*Haliotis sorenseni*	Haliotidae	Vetigastropoda

Mammal (Mammalia)

Common name	Scientific name	Family	Order
Beluga Whale	*Delphinapterus leucas*	Phocidae	Carnivora
Blue whale	*Balaenoptera musculus*	Balaenopteridae	Cetacea
Dugong	*Dugong dugon*	Dugongidae	Sirenia
False killer whale	*Pseudorca crassidens*	Delphinidae	Cetacea
Finback whale	*Balaenoptera physalus*	Balaenopteridae	Cetacea
Guadalupe fur seal	*Arctocephalus townsendi*	Phocidae	Carnivora
Humpback whale	*Megaptera novaeangliae*	Balaenopteridae	Cetacea
Killer whale	*Orcinus orca*	Cervidae	Artiodactyla
North Atlantic Right Whale	*Eubalaena glacialis*	Balaenidae	Cetacea
Northern Sea Otter	*Enhydra lutris kenyoni*	Mustelidae	Carnivora
Polar bear	*Ursus maritimus*	Ursidae	Carnivora
Seal, bearded (Atlantic)	*Erignathus barbatus barbatus*	Phocidae	Carnivora
Seal, bearded (Pacific)	*Erignathus barbatus nauticus*	Phocidae	Carnivora
Seal, Hawaiian Monk	*Monachus schauinslandi*	Phocidae	Carnivora
Seal, ringed (Arctic)	*Phoca hispida*	Phocidae	Carnivora
Seal, ringed (Baltic)	*Phoca hispida botnica*	Phocidae	Carnivora
Seal, ringed (Ladoga)	*Phoca hispida ladogensis*	Phocidae	Carnivora
Seal, ringed (Okhotsk)	*Phoca hispida ochotensis*	Phocidae	Carnivora
Seal, spotted	*Phoca largha*	Phocidae	Carnivora
Sei whale	*Balaenoptera borealis*	Balaenopteridae	Cetacea
Southern sea otter	*Enhydra lutris nereis*	Mustelidae	Carnivora
Sperm whale	*Physeter catodon (=macrocephalus)*	Physeteridae	Cetacea
Steller sea-lion	*Eumetopias jubatus*	Otariidae	Carnivora
West Indian Manatee	*Trichechus manatus*	Trichechidae	Sirenia
Whale, bowhead	*Balaena mysticetus*	Balaenidae	Cetacea
Whale, Gray	*Eschrichtius robustus*	Eschrichtiidae	Cetacea
Whale, North Pacific right	*Eubalaena japonica*	Balaenidae	Cetacea

Monocot (Liliopsida)

Common name	Scientific name	Family	Order
Johnson's seagrass	*Halophila johnsonii*	Hydrocharitaceae	Alismatales

Reptile (Reptilia)

Common name	Scientific name	Family	Order
Green sea turtle	*Chelonia mydas*	Cheloniidae	Testudines
Hawksbill sea turtle	*Eretmochelys imbricata*	Cheloniidae	Testudines

Reptile (Reptilia)

Common name	Scientific name	Family	Order
Kemp's ridley sea turtle	*Lepidochelys kempii*	Cheloniidae	Testudines
Leatherback sea turtle	*Dermochelys coriacea*	Dermochelyidae	Testudines
Loggerhead sea turtle	*Caretta caretta*	Cheloniidae	Testudines
Olive ridley sea turtle	*Lepidochelys olivacea*	Cheloniidae	Testudines
Saltwater crocodile	*Crocodylus porosus*	Alligatoridae	Crocodilia